The invention claimed is:

1.   A composite material for sensing an analyte, comprising:

a polymer matrix; and

a solid particulate filler dispersed in the polymer matrix, the solid particulate filler having functional groups capable of interacting with the analyte.

2.   The composite material of claim 1, in which the polymer matrix includes a polymer having a glass transition temperature at about room temperature or below room temperature.

3.   The composite material of claim 1, in which the polymer matrix includes a polymer selected from polycarbosilanes, polycarbosiloxanes and polycarbosilazenes.

4.   The composite material of claim 1, in which the solid particulate filler is a functionalized filler selected from clays, synthetic fibers, aluminum hydroxide, calcium silicate, zinc oxide, carbon fiber, glass fiber, silica, alumina, alumina-silica, carbon black, carbon nanotubes, and fullerenes.

5.   The composite material of claim 1, in which the solid particulate filler is a functionalized polyhedral oligomeric silsesquioxane.

6.   The composite material of claim 1, in which the solid particulate filler is functionalized with hydrogen bond acidic groups.

7.   The composite material of claim 6, in which the hydrogen bond acidic groups are selected from phenolic and alcoholic alkyl groups.

8.   The composite material of claim 6, in which the hydrogen bond acidic groups are selected from fluorinated phenols and fluorinated alcoholic alkyls.

9.   The composite material of claim 1, in which the solid particulate filler is functionalized with hydrogen bond basic groups.

10.   The composite material of claim 9, in which the hydrogen bond basic groups are selected from amine groups, ether groups, cyano groups, nitrogen and oxygen heterocyclic groups, groups containing phosphorous-oxygen double bonds, groups containing a sulfoxide moiety, groups containing a sulfone moiety, groups containing a nitro moiety, and groups containing a nitroso moiety.

11.   A chemical sensor comprising:
    a transducer element; and
    a layer of a composite material disposed on a surface of the transducer element, the composite material including a polymer matrix and a solid particulate filler dispersed in the polymer matrix.

12.   The chemical sensor of claim 11, in which the particulate filler has functional groups capable of interactions with an analyte.

13.   The chemical sensor of claim 11, in which the polymer matrix includes a polymer selected from polycarbosilanes, polycarbosiloxanes and polycarbosilazenes.

14.   The chemical sensor of claim 11, in which the solid particulate filler is a functionalized filler selected from clays, synthetic fibers, aluminum hydroxide, calcium silicate, zinc oxide, carbon fiber, glass fiber, silica, alumina, alumina-silica, carbon black, carbon nanotubes and fullerenes.

15.   The chemical sensor of claim 11, in which the solid particulate filler is a functionalized polyhedral oligomeric silsesquioxane.

16. The chemical sensor of claim 11, in which the solid particulate filler is functionalized with hydrogen bond acidic groups.

17. The chemical sensor of claim 16, in which the hydrogen bond acidic groups are selected from phenolic and alcoholic alkyl groups.

18. The chemical sensor of claim 17, in which the hydrogen bond acidic groups are selected from fluorinated phenols and fluorinated alcoholic alkyls.

19. The chemical sensor of claim 11, in which the solid particulate filler is functionalized with hydrogen bond basic groups.

20. A vapor sensing device containing an array of chemical sensors of claim 11 in which the composite layers are made either from a single polymer matrix and differently functionalized filler particles or from different polymer matrices and different functionalized filler particles.